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**METHOD AND DEVICE FOR PIVOTABLY DRIVING CARRIAGE AND
TIRE BUILDING SYSTEM USING SAME**

TECHNICAL FIELD

5 [0001] The present invention relates to a method for pivotably driving a carriage which is run over an oval-shaped endless moving path, a device for pivotably driving a carriage used for carrying out the method and a tire building system using the device. In particular, the present invention proposes a technique for eliminating a driving source such as a motor to be mounted on a
10 moving member such as a carriage, a carrier and the like.

RELATED ART

[0002] There are conventionally proposed various tire building systems in which tire components are mounted onto a tire building drum, respectively, in a
15 given order at workstations arranged along an endless rail, respectively, which constitutes an endless moving path of a carriage while the carriage equipped with the tire building drum is moved on the endless rail. Such a system is proposed in, for example, Japanese Patent Application No. 2002-341275 by the present applicant.

20 [0003] The proposed building system has workstations configured to mount tire components onto a building drum, respectively; a building carriage configured to support the building drum to thereby move the building drum among the respective workstations; and carriage guiding means for guiding a movement of the building carriage on a predetermined path; wherein the carriage
25 guiding means comprises: two inner and outer endless rails laid mutually parallel; and wheels provided on said building carriage, said wheels each being configured to roll, via roller or ball, on at least opposite side surfaces of associated one of said endless rails to thereby restrict a carriage position in a direction orthogonal to an extending direction of the endless rails; and
30 wherein the endless rails are each configured with at least one straight portion and at least one arcuate portion which are smoothly continued to each other, and the arcuate portion has a rail width narrower than a rail width of the straight portion by an amount corresponding to a radius of curvature of the arcuate

portion. According to this system, especially under an operation of the carriage guiding means which mainly constitutes of the pair of endless rails and the wheels provided on the building carriage to thereby tightly engage with at least opposite side surfaces of each of the endless rails and an operation of the arcuate
5 portion of the each of the endless rails which has a rail width narrower than that of the straight portion, the building carriage can be positioned with a higher precision relative to a direction intersecting the extending direction of the rail, thereby allowing a higher operating accuracy at each of the workstations by immediately achieving the predetermined accuracy of the stopping position of the
10 carriage. Thus, there can be fully excluded here a facility, time and space for lifting up, centering/positioning and transferring the building, so that all of the problems arisen from them can be effectively solved.

DISCLOSURE OF THE INVENTION

15 [0004] In these proposed techniques, however, when another driving means such as a motor for running the carriage is equipped on the carriage, supplies electricity and compressed air to the motor or the like are unavoidable, so that these techniques suffer from a problem that the configuration of the device is complicated and the installation cost, the running cost and the like are expensive.

20 [0005] The present invention aims to solve the above-mentioned problems and its object is to provide a method and device for pivotably driving a carriage, and a tire building system using same that can realize simplification of the configuration of the device and effective reduction of the installation cost and running cost, and, particularly, that enable to secure superior moving accuracy of
25 the carriage and to exert higher quietness and durability when the carriage runs over a curved portion of an oval-shaped endless moving path as well as allow simple and easy maintenance.

[0006] A method for pivotably driving a carriage according to the present invention comprises the steps of: engaging a carriage positioned on the ground
30 side at a curved portion of an oval-shaped endless moving path consisting of a pair of inner and outer endless rails with a carrier driven along the curved portion over, for example, its entire length when the carriage is driven under a guide of the rails; and towing the carriage over the entire length of the curved portion with

the carrier.

[0007] Preferably, the carrier is reciprocally moved along the same path by the action of traveling of a roller chain. It is also preferred that the carriage is positioned at the ground side by fitting a positioning pin displaced forwardly and
5 backwardly from the ground side onto the carriage while the carriage is engaged with the carrier by fitting an engagement pin displaced forwardly and backwardly from the carriage side onto the carrier.

[0008] Moreover, a series of pivotably driving processes are preferably carried out in the following ways: first, the carriage is engaged with the carrier in
10 a state where the carriage is positioned and locked on the ground side, then the carriage is unlocked and towed over the entire length of the curved portion by the carrier, and finally the carriage is again positioned and locked on the ground side as well as is disengaged from the carrier.

[0009] Meanwhile, the carrier which is moved outward while towing the
15 carriage in this way is preferably returned to the original position to wait for the next towing. Before the engagement/disengagement of the carriage with the carrier, compressed air is supplied to an engagement pin-actuating cylinder of the carriage.

[0010] A device for pivotably driving a carriage according to the present
20 invention is to implement any of the above-described method, wherein an endless roller chain which is traveled along the curved portion over its entire length in the horizontal plane is disposed with the roller axis being aligned with the vertical line, and one or more carrier, for example, only one carrier which can engage with/disengage from the carriage is mounted on the roller chain.

[0011] Preferably, a weight-supporting roll, for example, made of a resin
25 material is mounted on the roller chain at every given pitch of its chain link. In addition, a wear resistance resin material for contacting with the roller, such as ultrahigh molecular weight polyethylene, high molecular weight polyethylene, polyamide, MC nylon and polyacetal, is arranged on a chain guide at the position
30 which locates at least inside of the curvature of the roller chain extending along the curved portion and contacts with the chain.

[0012] It is also preferred that the roller chain extends between the pair of inner and outer rails and a driving train for the roller chain which manages

rotational driving of a chain sprocket is arranged between these rails as well.

[0013] In such a device, positioning pins which is displaced forwardly and backwardly from the ground side to engage with and disengage from the carriage as well as means for supplying compressed air which is connected to and
5 disconnected from an engagement pin-actuating cylinder of the carriage are preferably arranged on each of the positions backside of the entrance and front of the exit of the curved portion with respect to the traveling direction of the carriage.

[0014] A tire building system according to the present invention totally
10 employs any of the above-described devices for pivotably driving a carriage, the system comprising carriages on which a tire building drum is positioned and placed, a concurrent driving means such as a cylinder and ball screw which simultaneously and intermittently transmits each of a plurality of carriages aligned on a straight portion of an oval-shaped endless moving path over a given
15 distance, and workstations which perform given works on the tire building drum and are arranged at the positions respectively corresponding to the stopping positions of the carriages.

[0015] In the method for pivotably driving a carriage according to the present invention, since the carriage is towed by the carrier driven along the
20 curved portion, a driving means for moving the carriage is not necessarily mounted on the carriage and thus supplying electricity and compressed air to the driving means can be eliminated. As a result, it is possible to simplify a device for carrying out the method including the carriage and to, thereby, advantageously reducing the installation and running costs. It is also possible to
25 remove the risk of failure in the supplying systems of electricity, compressed air and the like to enhance the operation efficiency of the device as well as to simplify and facilitate maintenance of the device.

[0016] Further, if the carrier is driven in accordance with the running of the roller chain, the driving train with a simple configuration can give high moving
30 accuracy to the carriage and also good silence and durability into the driving train. In this case, a necessary movement of the carrier within a limited space can be secured in a small occupied space by forwardly and backwardly moving the carrier along the same path.

[0017] In such a method, when the carriage is positioned by the positioning pin displaced forwardly and backwardly from the ground side, the carriage can be effectively released from the power source. On the other hand, when the carriage and the carrier are engaged by the engagement pin displaced forwardly and backwardly from the carriage side, the carrier can be released from the power source to, thereby, further simplify its configuration as well as to further downsize whole the carrier.

[0018] Meanwhile, in this method, when the carriage is firstly engaged with the carrier in a state where the carriage is positioned and locked on the ground side of the carriage, then the carriage is unlocked and towed over the entire length of the curved portion by the carrier, and finally the carriage is again positioned and locked on the ground side as well as is disengaged from the carrier, the carriage can be smoothly and securely transferred to the carrier or the like at all times. In addition, when the carrier which is moved outward while towing the carriage is returned to the original position to wait for the next towing, the operation efficiency can be sufficiently enhanced.

[0019] In the device for pivotably driving a carriage according to the present invention, an endless roller chain which is traveled along the curved portion over its entire length in the horizontal plane is disposed with the roller axis being aligned with the vertical line, so that the configuration of the driving train of the carrier can be simplified and it is possible to realize the above-mentioned high moving accuracy, silence and durability of the carriage.

[0020] The roller chain may tow and transfer one carriage, if one carrier is attached to the roller chain, or simultaneously a plurality of carriages, if a plurality of carriers are attached to the roller chain with leaving a given space therebetween, during its single outward displacement.

[0021] When the weight-supporting roll is mounted on the roller chain, loosening of the chain or the like can be effectively removed to further improve the moving accuracy of the carriage and to effectively prevent an increase of travel resistance of the chain, unexpected wear and the like.

[0022] In addition, when the wear resistance resin material for contacting with the roller is arranged on a chain guide at the position which locates inside of the curvature of the roller chain extending along the curved portion and contacts

with the chain, each of the chain and chain guide, especially chain roller can be effectively prevented from being worn away. This may be further facilitated by arranging a wear resistance resin material on the chain guide at inside of the curved portion which consistently restrains the extending shape of the roller chain in a curved shape.

[0023] In such a device, when both of the roller chain and its driving train are arranged between a pair of rails, it is possible to easily secure a space for running the roller chain in an endless manner and to readily perform a maintenance of the roller chain and the driving train with exposing them between the rails.

10 [0024] Also, in such a device, when positioning pins which is displaced forwardly and backwardly from the ground side to engage with and disengage from the carriage as well as means for supplying compressed air which is connected to and disconnected from an engagement pin-actuating cylinder of the carriage are arranged on each of the positions backside of the entrance and front
15 of the exit of the curved portion with respect to the traveling direction of the carriage, the carriage can be positioned and locked on a given position and the engagement pin at the carriage side can be smoothly and securely engaged with and disengaged from the carrier.

[0025] Furthermore, in a tire building system according to the present
20 invention, the tire building drums are respectively positioned and placed on the carriages and a concurrent driving means such as a rodless cylinder simultaneously and intermittently transmits each of a plurality of carriages aligned on a straight portion of an oval-shaped endless moving path over a given distance, so that it is possible to effectively reduce the installation and running
25 costs of the driving train and to facilitate its maintenance.

[0026] In addition, when the workstations which perform given works on the tire building drum are arranged at the positions respectively corresponding to the stopping positions of the carriages, predetermined tire components can be simultaneously mounted onto the tire building drum at each of the workstations.
30 Moreover, when this is repeated until all of the mountings at the given workstations in the straight path portion are completed and these operations are conducted over entire or nearly entire circumference of the endless moving path while the carriages are moved, a desired tire can be efficiently built on the tire

building drum.

BRIEF DESCRIPTION OF THE DRAWINGS

[0027]

5 [FIG. 1] FIG. 1 is a schematic plan view of an embodiment of the tire building system.

[FIG. 2] FIG. 2 is a partially sectional elevation view of the endless rails and the wheel.

[FIG. 3] FIG. 3 is an enlarged plan view of a substantial part of an embodiment of the device for pivotably driving a carriage.

10 [FIG. 4] FIG. 4 is a sectional view taken along the line A-A of FIG. 3.

[FIG. 5] FIG. 5 is an enlarged sectional view of the wear resistance resin material.

[FIG. 6] FIG. 6 is a sectional view taken along the line B-B of FIG. 3.

15 [FIG. 7] FIG. 7 shows the processes of an embodiment of the method for pivotably driving a carriage.

BEST MODE FOR CARRYING OUT THE INVENTION

[0028] With reference to the drawings, one embodiment of the present invention will be discussed below. FIG. 1 is a schematic plan view of one
20 embodiment of a tire building system according to the present invention showing with a pre-building system. In the figure, the reference numeral 1 denotes a tire building system according to the present invention, and the reference numeral 2 denotes a pre-building system arranged next to the tire building system 1.

[0029] In this embodiment, the tire building system 1 has a building drum 3,
25 a carriage 4 which positions and places the building drum 3 on it to support the drum in a cantilever manner and which rotates about the center axis of the drum, and an generally ellipse-shaped endless moving path 5 which enables a circular traveling of the carriage 4. The system is also provided with eight workstations F1-F8 for mounting the tire component members on the building drum 3, and the
30 workstations are arranged along the moving path 5.

[0030] The pre-building system 2 has a supporting carriage 7 for supporting a cylindrical drum 6 in a cantilever manner, and a track 8 allowing the supporting carriage 7 to move linearly. The pre-building system 2 is also provided with

three workstations C1-C3 arranged along the track, and a transfer carriage 9 which contributes to the building at the workstation C3 and which transfers pre-built articles to the building drum 3 of the tire building system.

[0031] In this figure, the reference numeral 10 denotes a tire displacing carriage which receives a green tire G manufactured in the tire building system 1 from the building drum 3 on the moving path 5, and the reference numeral 11 denotes a conveyor for carrying the green tire received from the tire transfer carriage to a vulcanizing system.

[0032] In the pre-building system, the supporting carriage 7 supporting the cylindrical drum 6 is moved from the workstation C1 to C2, then from C2 to C3 and finally from C3 to C1, while the transfer carriage 9 is reciprocated between the workstations C3 and F1.

[0033] In the tire building system 1, the carriage 4 supporting the toroidally outwardly deformable building drum 3 moves clockwise from one workstation to the adjacent workstation among the workstations F1-F8, for example, from F1 to F2 and from F2 to F3, and these movement is repeated at a given takt time. It is noted that the tire building system 1 shown in this figure has eight carriages 4 arranged on the endless moving path 5 and each of the carriage 4 is driven between the workstations and positioned and stopped at each of the workstations with high accuracy, for example, by a driving device arranged inside of the path 5.

[0034] In this figure, the carriages 4 located at each of the straight portions of the moving path 5 are simultaneously and intermittently transmitted by concurrent driving means D1, D2 which commonly serve to each of the straight portions, respectively. The carriages 4 passing through each of the curved portions of the moving path 5 are driven by respective driving devices D3 and D4 consisting of roller chains arranged to endlessly extend between a pair of inner and outer endless rails along the curved portions, and chain driving trains preferably arranged between the rails. With such a configuration, an operator can supervise the status of building the tire at each of the workstations from inside of the pair of inner and outer endless rails. In this embodiment, a plurality of carriages are simultaneously driven by the respective driving devices D1, D2 arranged at the straight portions, so that the number of components

necessary for driving can be decreased to reduce the installation cost and improve the reliability of simultaneous driving or the like.

[0035] Positioning and locking of the carriages 4 on the positions precisely corresponding to the respective workstations F1-F8 after the carriages 4 are
5 stopped can be performed by, of course, the driving device itself. When the driving portions of the concurrent driving device D1, D2 are preliminarily returned to a given positions to wait for the next driving of the carriages 4 in order to reduce the takt time, the positioning and locking may be realized by another locking means such as a positioning lock pin separately provided on the
10 ground side.

[0036] The concurrent driving devices D1, D2 may be configured with a ball screw, cylinder or the like. For example, when it consists of a ball screw having a good driving accuracy, engagement pins displaced forwardly and backwardly by each of one or more female member, which may be a carriage-driving portion,
15 is fitted onto the respective carriages 4 or the engagement pins displaced forwardly and backwardly by each of the carriages 4 is fitted onto the female members, so that the carriages 4 are brought into connection with the ball screws, and, under such conditions, the simultaneous and intermittent driving of the plurality of carriages 4 by means of the ball screw can be achieved by rotating
20 the male members of the ball screws over a given turns.

[0037] On the other hand, the carriages 4 after completing the simultaneous and intermittent driving remain in the above-described connected state or are positioned by separate positioning lock pins to wait for the completion of given operations on the building drum 3 at each of the workstations F1-F8.

25 [0038] After finishing the operations at each of the workstations in this way, the female screw members which always have the same stroke at the same position are brought into engagement with the next carriages 4 to, thereby, simultaneously and intermittently displace the plurality of carriages again. Thereafter, identical operations are repeated to manufacture a given green tire on
30 each of the building drums 3.

[0039] In the pre-building system 2, prior to manufacturing the green tire on the tire building system 1 in this way, an inner liner member and a canvas chafer member are firstly mounted on the cylindrical drum 6 at the workstation C1 with

using an inner liner member-mounting device 12 and a canvas chafer member-mounting device 13, respectively. Then, the cylindrical drum 6 is moved to the workstation C2 and a squeegee member and a carcass member are mounted on the outer circumference of the inner liner member and the canvas chafer member
5 with using a squeegee member mounting device 14 and a carcass member mounting device 15 to, thereby, form a carcass band.

[0040] At the workstation C3, a pair of preset beads in which a bead filler is preset on a bead core are preliminarily set on the transfer carriage 9 by means of a handling robot 16. The carcass band formed at the workstation C2 is inserted
10 and arranged radially inside of the pair of preset beads already set, and the carcass band is transferred from the cylindrical drum 6 to the transfer carriage 9.

[0041] After that, the transfer carriage 9 gripping the preset beads and the carcass band is moved to the workstation F1 in the tire building system 1 in which the building drum 3 are ready, and they are transferred and placed on the
15 building drum 3. Such a placement can be performed by radially expanding the bead lock portion of the building drum 3 to lock the preset bead on the building 3, then releasing the transfer carriage 9 from the preset bead and returning the transfer carriage 9 to the station C3.

[0042] The specific operations at the workstations F2-F8 after the preset
20 beads and the carcass band are transferred in the building system in this way is, for example, that the building drum 3 is moved to the workstation F2, and the transversal center portion of the carcass band is toroidally outwardly deformed in accordance with the radial expansion of bladder and rigid core and the side portions of the carcass member are turned radially outwardly by the action of
25 carcass turning rod due to an actuation of an external driving device 17.

[0043] After that, the building drum 3 is sequentially moved among the workstations F3-F8 in the above-described manner and is positioned and locked on the workstations to carry out the following operations.

[0044] At the workstation F3, an inner layer belt member is mounted under a
30 support of an external force due to radially expanded rigid core by means of an inner layer belt member mounding device 18, and, at the workstation F4, an outer layer belt member is mounted by means of an outer layer belt member mounting device 19.

[0045] At the workstation F5, a spiral layer member and a tread undercushion member are mounted in this order by means of a layer member mounting device 20 and a tread undercushion member mounting device 21, respectively.

5 [0046] At the workstation F6, a base tread member is mounted by means of a base tread member mounting device 22, and, at the workstation F7, a cap tread member is mounted by means of a cap tread member mounting device 23.

[0047] Further, at the workstation F8, sidewall members are mounted on both sides of the tire in the course of building by means of a sidewall member mounting device 24, and rubber chafer members are mounted radially inside of
10 the sidewall member by means of a rubber chafer mounting device 35. A given green tire is built in this way.

[0048] In such a process of manufacturing the green tire, the building drum 3 makes it possible to toroidally expand the carcass band and mount various
15 members until completing the green tire while keeping the bead in the locked state, so that tire quality such as uniformity can be remarkably improved as compared with the conventional building method which have to unlock the beads between the operations to transfer them among the workstations.

[0049] The completed green tire G is subjected to an operation such as
20 attaching a barcode at the final workstation F9, then it is removed from the building drum 3 by the tire transport carriage 10 to pass over to a tire carrying conveyor 11 which carries it to a tire vulcanization system.

[0050] Meanwhile, the building drum 3 in such a building system 1 is so configured that distances between the bead lock portions and between the rigid
25 cores on the right and left sides may be arbitrarily changed to be able to deal with tire component members in different widths. However, for the tires having different rim diameters, it is necessary to replace the building drum itself to handle them. Therefore, in this embodiment, a drum replace station D is arranged next to the track 5 in order that the building drum can be replaced
30 within a given takt time.

[0051] In the above-described tire building system 1, in order to guide the movement of the carriage 4 on the endless moving path 5, a pair of inner and outer endless rails 31, 32 are laid in parallel to each other on the ground side, and

wheels 33 which tightly engage with the endless rails 31, 32 to precisely restrict the position of the carriage in the direction perpendicular to the extending directions of the rails 31, 32 are provided on the carriage 4.

[0052] As shown in FIG.1, the endless rails 31, 32 are in parallel to each other, oppositely placed and preferably composed of two straight portions with an equal length and two arcuate curved portions which smoothly connect the both ends of the straight portions. Preferably, each of the wheels 33 which engage with the rails 31, 32 tightly, in other words, without any play is provided with a plurality of balls rolling on the both sides of the rails 31, 32 or is provided with a plurality of rollers rolling on the both side and the top of the rails 31, 32 to improve the position-restricting function of the wheels 33. In the former case, the wheels 33 preferably consist of a ball-recirculation type slide table such as a slider in a direct movement guide.

[0053] In order to obtain higher moving accuracy of the carriage 4, at the curved portions of the endless moving path 5, i.e. the arcuate curved portions smoothly connecting the straight portions of the endless rails 31, 32, as can be seen in FIG. 3 shown as a enlarged plan view of a substantial part, an endless roller chain 34 which is driven in the horizontal plane is arranged and extended between the curved portions 31a, 32a of the rails 31, 32, respectively, along the entire curved portions 31a, 32a, in this example over the entire length of the curved portions 31a, 32a, with the roller axis being aligned with the vertical line. Also, the extended ends of the roller is preferably arranged to be winded around the driving and driven sprocket 35, 36, respectively, and a carrier 37 which is engaged with and disengaged from the carriage 4 is attached to the roller chain 34 at the extending part, in this example the outer extending part of the curved portion. The carrier 37 is preferably movable on the midpoint between the rails 31, 32 based on the displacement of the roller chain 34.

[0054] The driving sprocket 35 is connected to a motor 39 via, for example, a chain 38 to forwardly and reversely drive the roller chain itself, more precisely to move the carrier 37 back and forth between the sprocket 35, 36.

[0055] The chain 38 and motor 39 which are used as a driving train of the roller chain 34 may be arranged either inside or outside of the rails 31, 32, of course, and, as can be seen in the figure, they may be arranged between the rails

to facilitate the maintenance of the roller chain 34 including the driving train.

[0056] To the roller chain 34 thus arranged, a weight-supporting rolls 40 which roll on the horizontal plane and which may be made of polyacetal are preferably attached at every given pitch of the chain link of the chain 34, as exemplarily shown in FIG. 4 taken along the line A-A of FIG. 3, to support the weight of the chain with the supporting rolls 40 and, thereby, effectively remove loosening of the roller chain 34.

[0057] A wear resistant resin material 42 is preferably arranged on the chain guide 41 by fixing or gluing to ensure the wear resistance of the roller chain 34 and chain guide 41. In this embodiment, the chain guide is disposed at the curved portion of the roller chain itself extending along the arcuate curved portions 31a, 32a, restricts the curve of the chain, has an L-shaped cross section and constitutes the rolling path of the supporting roll. The wear resistant resin material contact the roller 34a of the chain 34 as shown in FIG. 5 with enlarging the substantial portion and is made of, for example, ultrahigh molecular weight polyethylene, high molecular weight polyethylene, polyamide, MC nylon and polyacetal.

[0058] The carriage 4 can be engaged with the carrier 37 attached to the roller chain by inserting the engagement pin 43 provided on the carriage 4 into the engagement hole 37a provided on the carrier 37 with an action of an air cylinder, as shown in FIG. 6 which is a sectional view of carrier 37 taken along the line B-B in FIG. 3 in a state where the carrier 37 is aligned with the driven sprocket 36. Such an engagement may be released by exhausting the pressure in the air cylinder to return the engagement pin 43 by itself, or by supplying the pressure to the reciprocal air cylinder. When the engagement pin 43 engages with the carrier 37, it is possible to tow the carriage 4 over the entire length of the arcuate curved portions 31a, 31b along with the carrier 37 moved by the driving of the roller chain 34.

[0059] For the purpose of engagement/disengagement actions of the engagement pin 43 on the carriage 4, a compressed air supplying means which supplies pressure to a pin actuating cylinder of the carriage 4 at least before, and preferably before and after starting to tow the carriage 4 is preferably provided on the actuating cylinder in a connectable and detachable manner. This can

sufficiently eliminate complexity of pipes and their arrangement as well as a likelihood of an improper operation by separating the compressed air supplying means from the actuating cylinder of the carriage 4 at least during the carriage 4 being moved.

5 [0060] Accordingly, after the engagement pin 43 of the carriage 4 is engaged with the carrier 37 by means of the compressed air from the compressed air supplying means, the compressed air supplying means is separated from the carriage 4 to securely maintain the engagement state. On the other hand, after
10 towing of the carriage 4, pressure is supplied by another compressed air supplying means connected to the actuating cylinder to disengage them, and thus the carriage 4 is completely separated from the carrier 37 to sufficiently allow the concurrent driving means to intermittently transmit the carriage 4.

[0061] In addition, in order to enable smooth and secure engagement and disengagement of the engagement pin 43 with the carrier 37, positioning means
15 44 for positioning and locking the carriage 4 on the ground side are arranged on each of the positions backside of the entrance and front of the exit of the curved portions 31a, 32a with respect to the traveling direction of the carriage. The positioning means consist of a pneumatic cylinder 45 attached perpendicular to the floor and a positioning pin 46 displaced back and forth by the cylinder 45.
20 The positioning pin 46 is inserted into a notch 47 or a hole formed in the carriage 4 to position and lock the carriage 4 at the ground side.

[0062] In order for the carriage engaged with the endless rails 31, 32 to be moved along and passed over the arcuate curved portions 31a, 32a of the endless rails by means of the device for pivotably driving the carriage thus configured,
25 for example, after the concurrent driving means D1, D2 linearly transmitting the carriage 4 on which the building drum 3 for the green tire is positioned and placed, the positioning pin 46 provided on the ground side is firstly fitted in the notch 47 on the carriage to position and lock the carriage 4 on the ground side. Then, as schematically illustrated in FIG. 7(a), the engagement pin 43 is
30 displaced forwardly by the supplied pressure from the compressed air supplying means 48 connected to the carriage 4 to engage the pin 43 with the carrier 37. Subsequently, as shown in FIG. 7(b), the compressed air supplying means 48 is separated from the carriage 4 and the positioning pin 46 is withdrawn to release

the restriction of the carriage 4 at the ground side.

[0063] After that, the driving trains 38, 39 of the roller chain 34 are actuated to displace the roller chain itself. This causes the carrier 37 attached to the chain 34 to forwardly move entirely over the curved portions 31a, 32a. As a
5 result, the carriage 4 is towed and passed over the curved portions 31a, 32a.

[0064] In this case, the towing of the carriage 4 can be performed with high positioning accuracy, so that even if the one or more workstation is provided in the curved portions 31a, 32a, the carriage 4 can be accurately positioned and stopped at the given position and be locked there.

10 [0065] After the carriage completely passing over the curved portions, in order to relegate the transmission of the carriage 4 to the concurrent driving means D1, D2, the carriage 4 is positioned and locked at the ground side by the positioning pin 46 and the engagement pin 43 is backwardly moved while the compressed air supplying means 45 is connected to the carriage 4 as shown in
15 FIG. 7(c). As shown in FIG. 7(d), the engagement between the engagement pin and the carrier 37 is released, and the compressed air supplying means 48 is again separated from the carriage 4.

[0066] In this way, the carriage 4 and thus the building drum 3 placed on the carriage pass over the curved portions 31a, 32a and thereafter they are
20 sequentially, linearly and intermittently driven to each of the workstation F1-F8 by the concurrent driving means D1, D2, as described in the above. At each of the stations, a given operations is carried out on the building drum 3.

[0067] The carrier 37 which finishes the towing of the carriage 4 and is released from the carriage 4 is backwardly moved on the same path as the
25 forward movement to the original position by the reverse movement of the roller conveyor 34. The carrier waits for the next similar towing there.

[0068] Therefore, it is not necessary to provide a driving means such as a motor on the carriage 4 for driving the carriage 4 on the curved portions of the oval-shaped endless moving path. This is also applied to the carrier 37, so that
30 it is possible to simplify and downsize the configuration of the carriage and carrier itself. Further, it is also possible to simplify the entire configuration of the pivotably driving device to advantageously reduce the installation and running costs.

[0069] The above description, merely one embodiment according to the present invention has been described with reference to the drawings. Components other than a tire building drum may be placed on the carriage, and the carriage may pivotably move by itself.